Maryland State STEM Standards of Practice Instructional Guide Grade K

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Maryland State Department of Education

Preparing World-Class Students

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Introduction

STEM Education

STEM education is an approach to teaching and learning that integrates the content and skills of science, technology, engineering, and mathematics. STEM Standards of Practice guide STEM instruction by defining the combination of behaviors, integrated with STEM content, which are expected of a proficient STEM student. These behaviors include engagement in inquiry, logical reasoning, collaboration, and investigation. The goal of STEM education is to prepare students for post-secondary study and the 21st century workforce.

STEM education removes the artificial barriers that isolate content and allows for an integrated instructional approach. The curriculum should allow students to develop life skills and apply content knowledge within a real world context. STEM education is active and focuses on a student-centered learning environment. Students engage in questioning, problem solving, collaboration, and hands-on activities while they address real life issues. In STEM education, teachers function as classroom facilitators. They guide students through the problem-solving process and plan projects that lead to mastery of content and STEM proficiency. STEM proficient students are able to answer complex questions, investigate global issues, and develop solutions for challenges and real world problems while applying the rigor of science, technology, engineering, and mathematics content in a seamless fashion. STEM proficient students are logical thinkers, effective communicators and are technologically, scientifically, and mathematically literate.

STEM Education Pipeline

Elementary School

The development of STEM proficient students begins in elementary schools. In the elementary grades, students apply the rigor of science, technology, engineering, and mathematics content and the STEM Standards of Practice while engaged in learning activities that investigate the natural world. Students explore technology and engineering solutions and appropriately apply the concepts of mathematics in order to understand and address real life issues and solve problems or challenges. As students progress through elementary school they will begin to independently integrate the STEM Standards of Practice. They will understand how to apply the roles and views of STEM career professionals and analyze real world STEM issues, problems, or challenges as they incorporate STEM content, skills, and practices and other disciplines such as social studies, performing arts, health, and creative movement.

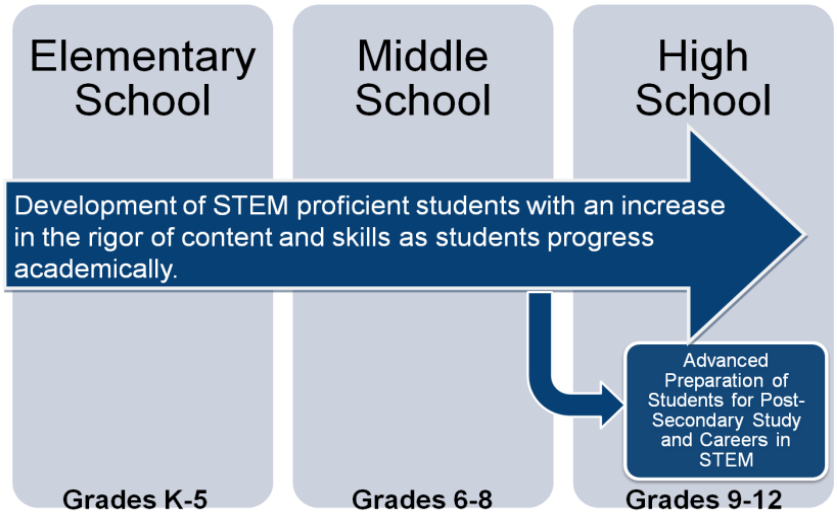
Middle School

STEM education in middle school builds upon the foundational skills developed by students throughout elementary school. STEM essential skills and knowledge are further developed through guided instruction by the middle school teacher. Teachers facilitate learning activities that intentionally allow for middle school students to analyze and integrate content from science, technology, engineering, and mathematics to investigate global issues, answer complex questions, and develop solutions for challenges and real world problems. Middle school students will ask relevant questions, conduct research, refine questions based on research, and develop new questions that are relevant to understanding problems, global issues, or challenges. Teachers will also facilitate learning activities that allow middle school students to refine critical thinking skills by applying scientific investigation and the engineering design process. By the end of eighth grade, students will be able to independently synthesize multi-disciplinary content to answer complex questions, investigate global issues, and develop solutions for challenges and real world problems.

High School

There are two goals for STEM education in high school. The first goal is on the development of STEM proficient students. All students will continue to grow in their STEM proficiency as they progress from grades 9:12. Students demonstrate independence and become more focused and sophisticated in their approach to answering complex questions, investigating global issues, and developing solutions for challenges and real world problems. STEM proficient students graduate with the basic skills and knowledge required to pursue post-secondary study or work in any field.

The second goal for STEM education in high school is on the advanced preparation of students for post-secondary study and careers in science, technology, engineering, or mathematics. High school provides a unique opportunity for students to explore different career paths and college majors through advanced coursework, career academies, magnet programs, STEM academies, specialized STEM programs, internships, and dual enrollment opportunities. Specific programs to address the needs for advanced preparation of students shall be determine by individual schools systems.



Overview:

In September 2008, Governor Martin O'Malley convened a P-20 STEM Task Force to discuss the state of STEM education in Maryland. As a result of the task force work, specific recommendations were made aimed at establishing Maryland as a global leader in the development of its workforce of the future, STEM-based research, and economic development infrastructure. The task force's recommendations were included in Maryland's application for a Race to the Top Grant. The grant describes twelve STEM-related projects, including developing STEM-based curriculum. The curriculum development process began in 2011 when Maryland State Department of Education staff specialists joined with stakeholders from across the state to define STEM education and develop STEM Standards of Practice. A total of 961 stakeholders reviewed and provided input on the STEM Standards of Practice via an on-line survey and face-to-face meetings. Stakeholders included representatives from all 24 Maryland local school systems, businesses and governmental agencies, colleges and universities, and other members of the community. In April 2012, the Maryland State Board of Education accepted the Maryland State STEM education definition and STEM Standards of Practice.

The development of the Maryland State STEM Standards of Practice Frameworks began in 2012 when the Office of STEM Initiatives convened multidisciplinary design teams. Design teams consisted of Maryland educators representing grades K-12 and higher education. The design teams identified what students should know and do to demonstrate proficiency with each STEM Standard of Practice by the end of grades K, 2, 5, 8, and 12. The Maryland State Department of Education staff and other stakeholders reviewed and refined the work of the design team. This document represents the culminating work of the design team and other stakeholders in identifying the essential skills and knowledge of STEM proficient students.

The purpose for the Maryland State STEM Standards of Practice Frameworks is to lay a foundation of STEM Education for all students. The Frameworks provide teachers and students a consistent approach to implementing STEM education and will provide guidance for teachers as they develop STEM centric units or lessons that focus on answering complex questions, investigating global issues, and developing solutions for challenges and real world problems.

Implementation of the Maryland State STEM Standards of Practice Frameworks

The Maryland State STEM Standards of Practice cross all grade levels and disciplines. Instruction in STEM education is a shared responsibility within a school. Therefore, all classroom teachers, supporting teaching staff, and special area teachers (e.g.: special education, gifted and talented, enrichment programs, afterschool programs, summer programs) can use the Maryland State STEM Standards of Practice Frameworks to engage students in STEM activities and tasks that develop STEM proficiency. Students should be given the opportunity to practice the essential skills and knowledge described while learning content. Implementation could occur through projects/themes that span multiple disciplines or through appropriate content-based infusion.

Limitations of the Frameworks

1. The Maryland State STEM Standards of Practice Framework sets the foundation for curriculum development by identifying process standards that are designed to be used with content standards.
2. The Maryland State STEM Standards of Practice are holistic in nature and have equal importance towards the development of STEM proficient students. The Framework is not intended to convey a hierarchical or sequential order for essential skills and knowledge, proficiencies, or standards.
3. The Maryland State STEM Standards of Practice Framework are written in grade bands to give school systems flexibility in the incorporation of STEM Standards of Practice in various content areas. Teachers should promote the development of the essential skills and knowledge over the course of grades K-5, 6-8, and 9-12.
4. The Maryland State STEM Standards of Practice Framework is a curriculum guide for educators. Teachers will need to plan accommodations, interventions, or enrichments required for special need students, English language learners, or gifted and talented students. Individual school systems can determine the appropriate modifications to meet the needs of their diverse populations.

STEM Education in Elementary Schools

In elementary STEM classrooms, students are actively engaged in questioning and hands-on activities while they investigate global issues, and solve real world problems, and/or challenges. Teachers facilitate student engagement, arouse student's questioning, guide students through the problem-solving process, and plan student projects that center on student's interest. As early as kindergarten, their learn to: ask and answer questions about real-life topics that affect their lives and the lives of others around them, solve problems, and explore STEM-related careers by learning and role-playing what scientists, technologists, technicians, engineers and mathematicians do in their career field. Grade: Kindergarten, students should have been introduced to STEM Standards of Practice that will engage them in scientific process, Maryland Technology Literacy Standards for Students, engineering design processes, and mathematics content and practices.

As students mature in age, first and second grade students begin to apply, with some assistance from the teacher, science, technology, engineering, and mathematics content while engaging in activities that focus on real-world questions, issues, problems or challenges. Students begin to independently explore real-world problems, apply the process of problem solving, scientific process, engineering design process, and Standards for mathematical Practices, integrate STEM Standards of Practice, form STEM teams, and work cooperatively and collaboratively in groups.

Grades: First through Second, students will have a clear understanding of STEM content, skills, and practices, and they would have been exposed to inquiry-based, problem-based, and project-:based learning. Beginning in the third grade, students focus on demonstrating an understanding of how to connect science, technology, engineering and mathematics content, practices or processes while engaging in inquiry-based, problem-based, and project-based learning activities. By the end of third grade, students will be able to integrate STEM content, practices and processes to other disciplines when asking questions, solving problems, or meeting challenges. Students should also begin to apply the STEM Standards of Practice that will engage them in scientific process, Maryland Technology Literacy Standards for Students, engineering design processes, and mathematics content and practices.

By the end of fourth grade, students will be able to: design projects that are innovative and creative, analyze complex issues, solve complex problems and/or challenges, and independently apply STEM Standards of Practice into STEM activities. Students role play STEM professionals while engaged in STEM teams, incorporate engineering design process, science practices and Standards for Mathematical Practices into STEM activities, and logical reasoning when addressing or solving STEM related issues, problems, and/or challenges.

Grades: Third through Fifth, students will be able to independently demonstrate grade appropriate proficiency in all four STEM content areas, research various types of STEM subject matter experts in STEM fields, perform a STEM subject matter expert role when engaged in STEM teams, integrate other disciplines when engaging in a STEM lesson and/or project, and evaluate whether they have appropriately applied the STEM Standards of Practice while engaged in STEM activities. Student should also be able to independently demonstrate the science practices and Standards for Mathematical Practices, all K - 5 Maryland Technology Literacy Standards for Students, engineering design process, and inquiry-base, problem-base and project-base learning processes.

Elementary STEM Standards of Practice and Framework

The purpose for having Elementary STEM Standards of Practice and Framework is to lay a foundation of STEM Education for all students. STEM education is embedded in all content areas, specifically science, technology, engineering and mathematics. This document was designed by teachers and STEM coordinators from various grade levels, special education, English language learner, and English for speakers of other languages, and gifted and talented programs.

How to Read this Document

The curriculum writers approached the STEM Standards of Practice holistically: meaning, equal emphasis is given to each STEM Standards of Practice making each STEM Standards of Practice very important. The writers also applied a Transdisciplinary approach to STEM education where students answer complex questions, investigate global issues, and develop solutions to real world problems or challenges.

Overall Document Organization

The STEM Standards of Practice and Framework are comprised of seven practices. Each practice title is listed with a STEM proficient student statement explaining what a STEM proficient student will demonstrate. Each STEM Standard of Practice may list two or more student proficiencies, which are uppercase, letter A, B… A STEM proficiency statement is the behavior students are to demonstrate while engaged in STEM task over a course or year. The section identifying K, 2 and 5 represents Grade: Kindergarten, Grades: First through Second, and Grades: Third through Fifth. The essential skills and knowledge section includes a precursor statement explaining the expectation and support students will need to become a STEM proficient student. This section also contains skills and knowledge students will learn. Note: These bullets are not inclusive of all skills and knowledge students may demonstrate while engaging in STEM activities or tasks. Appendix A includes glossary words, and Appendix B is a list of references and online recourses.

Who is responsible for STEM Standards of Practice and Framework?

STEM is for all students. Therefore, all elementary classroom teachers, support teaching staff, special area teachers: art, music, library, physical education, inclusive or special education, gifted and talented, English language learners, and English for speakers of other languages, enrichment programs, afterschool programs and summer programs can use these STEM Standards of Practice and Framework to engage student in STEM activities and tasks. School administrators can also apply STEM Standards of Practice and Framework into the daily instruction in ELA, mathematics, social studies, science, and other discipline academic time blocks.

Formatting Notes: Black Print – Essential skills and knowledge identified by Maryland educators. These statements are intended to help teachers develop common understanding and valuable insights into what a student must know and be able to do to demonstrate proficiency with each STEM Standard of Practice; **Blue Print** : Glossary terms**;** and ***Purple Print*** **–** Essential skills and knowledge from other Maryland State Curriculum Standards.

Maryland State STEM Standards of Practice

1. **Learn and Apply Rigorous Science, Technology, Engineering, and Mathematics Content**

   STEM proficient students will learn and apply rigorous content within science, technology, engineering, and mathematics disciplines to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

   A. Demonstrate an understanding of science, technology, engineering, and mathematics content.
   B. Apply science, technology, engineering, or mathematics content to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

2. **Integrate Science, Technology, Engineering and Mathematics Content**

   STEM proficient students will integrate content from science, technology, engineering, and mathematics disciplines as appropriate to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

   A. Analyze interdisciplinary connections that exist within science, technology, engineering, and mathematics disciplines and other disciplines.
   B. Apply integrated science, technology, engineering, mathematics content, and other content as appropriate to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

3. **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

   STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

   A. Identify, analyze, and synthesize appropriate science, technology, engineering, and mathematics information (text, visual, audio, etc.).
   B. Apply appropriate domain-specific vocabulary when communicating science, technology, engineering, and mathematics content.
   C. Engage in critical reading and writing of technical information.
   D. Evaluate and integrate multiple sources of information (e.g.: quantitative data, video and multimedia) presented in diverse formats.
   E. Develop an evidence-based opinion or argument.
   F. Communicate effectively and precisely with others.

4. **Engage in Inquiry**

   STEM proficient students will engage in inquiry to investigate global issues, challenges, and real world problems.

   A. Ask questions to identify and define global issues, challenges, and real world problems.
   B. Conduct research to refine questions and develop new questions.

5. Engage in Logical Reasoning

STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

A. Engage in critical thinking.
B. Evaluate, select, and apply appropriate systematic approaches (scientific and engineering practices, engineering design process, and/or Standards for mathematical Practices).
C. Apply science, technology, engineering, and mathematics content to construct creative and innovative ideas.
D. Analyze the impact of global issues and real world problems at the local, state, national, and international levels.

6. Collaborate as a STEM team

STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

A. Identify, analyze, and perform a STEM specific subject matter expert role.
B. Share ideas and work effectively with a STEM focused multidisciplinary team to achieve a common goal.
C. Listen and be receptive to ideas of others.
D. Analyze career opportunities that exist in a variety of STEM fields relevant to the STEM focused multidisciplinary team's goal.

7. Apply Technology Strategically

STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

A. Identify and understand technologies needed to develop solutions to problems or construct answers to complex questions.
B. Analyze the limits, risks, and impacts of technology.
C. Engage in responsible/ethical use of technology.
D. Improve or create new technologies that extend human capability.

STEM Standard of Practice 1: **Learn and Apply Rigorous Science, Technology, Engineering, and Mathematics Content**

STEM proficient students will learn and apply rigorous content within science, technology, engineering, and mathematics disciplines to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

A. Demonstrate an understanding of science, technology, engineering, and mathematics contents.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Name concepts presented in grade level *science*, *technology*, *engineering*, and *mathematics* content. • Match picture connections between content and real life. • Retell which *science practices and Standards for Mathematical Practices* are being used when solving problems. • Identify the steps of the engineering design process when engaged in STEM activities. • Identify the *Maryland Technology Literacy Standards for Students*.	**Teacher Note:** ○ Teachers can model science note booking. Teachers could make observations during content centers, take anecdotal records. ○ Students should demonstrate some of these practices but may not recognize the connection between the skill and the practice. ○ Children should begin to recognize appropriate content vocabulary: ruler, thermometer, design, etc. and use in the correct content. ○ Children should begin to recognize appropriate content symbols: +, -, =, etc. and use in the correct content ○ Children use their senses when solving problems in content areas. Young children need to see and feel in order to describe and make connections. A discovery approach should be used.	**For Planning** **Common Core State Standards** **A Framework for K-12 Science Education** http://www.nap.edu/catalog.php?record_id=13165 **MD Technology Literacy Standards for Students K-8** http://marylandpublicschools.org/NR/rdonlyres/CFAE6DE8-94E4-4D72-A1DE-50061B2B2A05/13089/MTLSSComplete1.pdf **Maryland Common Core State Curriculum Frameworks – Mathematics** http://mdk12.org/instruction/curriculum/mathematics/index.html **Skill Builders** www.internet4classrooms.com	**Anecdotal Records** Significant incidents or specific, observable behaviors can be recorded by teachers in anecdotal records. These records provide cumulative information about students' development in the learning objectives of the language arts as well as their physical and social growth and development. By systematically collecting and analyzing anecdotal comments, teachers can evaluate students' progress and abilities to use language and then plan appropriate instruction. **Engineering design process** The process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic science and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective.

STEM Standard of Practice 1: **Learn and Apply Rigorous Science, Technology, Engineering, and Mathematics Content**

STEM proficient students will learn and apply rigorous content within science, technology, engineering, and mathematics disciplines to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

B. Apply science, technology, engineering, and mathematics content to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Begin to think and ask questions about science and mathematics content. • Recall *science* or *mathematics* content to answer questions or solve real world problems. • Name *science* or *mathematics* content or practices when exploring global issues. • Tell how *science, technology*, *engineering*, or *mathematics* content is used by people every day.	**Teacher Notes:** Students will make beginning connections between a problem and the answer (understand the steps involved in solving a problem). Model sequencing - what comes first, next, last. Children are encouraged to form and ask questions about the content. Students can use their senses to ask simple questions about the experiment, problem, or experience using: ○ What does it look like? What does it feel like? What attributes do you see? How is this the same as other things? **Suggested Activities:** ○ After reading a story related to content, teachers can guide students to have appropriate discussions and ask appropriate questions related to the content. ○ Through drawing/writing/verbalizing students will demonstrate an understanding of content. Students can illustrate an experiment or observation they made in science. Encourage students to add words or labels to their pictures. Students can then describe/explain their picture to a friend or an adult. ○ Use format of a well designed investigation: questions, predictions, collect data, conclude using evidence. ○ When building/solving problems, introduce an engineering design process.	**For Planning** **Common Core State Standards** **A Framework for K-12 Science Education** http://www.nap.edu/catalog.php?record_id=13165 **MD Technology Literacy Standards for Students K-8** http://marylandpublicschools.org/NR/rdonlyres/CFAE6DE8-94E4-4D72-A1DE-50061B2B2A05/13089/MTLSSComplete1.pdf **Maryland Common Core State Curriculum Frameworks – Mathematics** http://mdk12.org/instruction/curriculum/mathematics/index.html	**Global issues** Issues that impact the Earth as a whole, problems that concern a population throughout the world. An global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world. **Real world problems** Problems that actually occur in everyday life.

STEM Standard of Practice 2: **Integrate Science, Technology, Engineering, and Mathematics Content**

STEM proficient students will integrate content from science, technology, engineering, and mathematics disciplines as appropriate to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

A. Analyze interdisciplinary connections that exist within the science, technology, engineering, and mathematics disciplines and other disciplines.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Discover the connections between *science, technology, engineering*, and *mathematics* disciplines and other disciplines. • Retell information from *science, technology, engineering*, and *mathematics* information to answer questions, investigate global issues, or solve real world problems or challenges. *(CCSS RI.K.2)* • Begin to understand *science practices* or *Standards for Mathematical Practices* when solving real world problems or challenges.	**Teacher Note:** Teachers should be intentional when modeling connections between these disciplines: ○ Point out to students when doing Science they are using Mathematics when gathering data (e.g., sorting, classifying, comparing). ○ Find ways to incorporate technology when gathering data. ○ Model that reading and research is an important tool for understanding their discoveries. ○ Teachers should recognize that the skills and practices used within mathematics, language arts, and sciences are related, but discipline specific. ○ Teachers should model and encourage metacognitive strategies such as ability to compare, applying precision and accuracy, and labeling.	**For Planning** **Kindergarten Center Ideas** www.kellyskindergarten.com (please note these centers are for ideas only, not all are appropriate) **NASA B.E.S.T** – online teacher resource http://www.nasa.gov/audience/foreducators/best/ **For Lesson Use** **PBS Kids – SciGirls Show** www.pbskids.org/scigirls	**Connections** The relationship of something with its context. **Global issues** Issues that impact the Earth as a whole, problems that concern a population throughout the world. A global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world. **Real world problems** Problems that actually occur in everyday life. **Challenges** A problem or concern that should be addressed. A competition.

STEM Standard of Practice 2: **Integrate Science, Technology, Engineering, and Mathematics Content**

STEM proficient students will integrate content from science, technology, engineering, and mathematics disciplines as appropriate to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

B. Apply integrated science, technology, engineering, and mathematics contents to develop solutions to problems or construct answers to complex questions.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Recall connections between grade level *science* and *mathematics* content. • Retell *science* or *mathematics* content to answer questions or solve problems.*(CCSS RI.K.2)* • Match one or more STEM content areas using pictures or objects to answer questions, explore global issues or solve real world problems or challenges.	**Teacher Note:** In the second semester teachers should provide opportunities for students to begin applying content knowledge when given real world problems or challenges or when asked questions about the content. **Suggested Activities:** ○ Centers should allow students to engage in more problem solving opportunities. Teachers provide guiding questions or a scenario for students to role play. ○ Examples: When studying needs of living things, create a center for students to be a scientist or zoologist and take care of animals in their native/created habitat. ○ When studying forces-push/pull, create a center for students to be architects/engineers and design roads, buildings and cities. ○ After reading a story related to content, teachers can guide students to have appropriate discussions and ask appropriate questions related to the content.	**For Planning** **Kindergarten Center Ideas** www.kellyskindergarten.com (please note these centers are for ideas only, not all are appropriate) **NASA B.E.S.T – online teacher resource** http://www.nasa.gov/audience/foreducators/best/ **For Lesson Use** **PBS Kids – SciGirls Show** www.pbskids.org/scigirls	**Connections** The relationship of something with its context. **Global issues** Issues that impact the Earth as a whole, problems that concern a population throughout the world. A global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world. **Real world problems** Problems that actually occur in everyday life. **Challenges** A problem or concern that should be addressed. A competition.

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

A. Identify, analyze, and synthesize appropriate science, technology, engineering, and mathematics information (text, visual, audio, etc.).

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Listen to text, visual or audio information from *science*, *technology*, *engineering* or *mathematics* content. *(CCSS RI.K.10)* • Participate in conversation with adults and peers. *(CCSS SL.K.1a)* • Ask questions to clarify meaning. *(CCSS SL.K.2; SL.2)* • Recall global issues from text, visual, audio, etc. • Discover real world problems through multiple sources.	**Teacher Notes:** Refer to the new Bloom's Taxonomy for potential activities and products. **Suggested Activities:** ○ Use/create graphs to display information (picture graphs). ○ Comparing/contrasting an object or idea. ○ Use appropriate vocabulary to answer questions. ○ Through oral presentations, answer a question and explain thinking. When doing a STEM activity and solving a problem students can create a photo book to explain their thinking and describe the process they used during design.	**For Planning:** **Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html (CCSS K RL,3) www.odu.edu **New version of Bloom's Taxonomy** http://teachers.ash.org.au/researchskills/dalton.htm **UDL** www.cast.org	**Global issues** Issues that impact the Earth as a whole, problems that concern a population throughout the world. A global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world. **Real world problems** Problems that actually occur in everyday life.

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

B. Apply appropriate domain specific vocabulary when responding and discussing science, technology, engineering, and mathematics contents.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • With modeling and support, answer questions about unknown words in text. *(CCSS RI.K.4)* • With modeling and support, activate prior knowledge and experiences to determine the meaning of unknown words. *(CCSS RI.K.4)* • With modeling and support, use text, illustrations, graphics aides (e.g. print features, size of print, illustrations/photographs, drawings, maps, graphs and diagrams) to identify meaning of unknown words. *(CCSS RI.K.4; See MTLS K.4.B.1a)* • Draw or write symbols or words used in *science*, *technology*, *engineering* or *mathematics*.	**Suggested activities:** ○ Content word wall separated from the sight word wall. ○ Utilize word wall to support daily instruction. ○ ***Students and Teacher interact with the word wall (e.g. create pictures to go with the words, take the words down and trace with dry erase markers, bring words to table to use to write with, put up words/take words down when being used) ○ Identify vocabulary when reading related text in class. ○ Use domain specific vocabulary in writing and discussions. ○ Home connection – send home domain specific vocabulary as they are introduced so that parents can reiterate the importance.	**For Planning:** **Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html (CCSS K RL,4) **ReadWriteThink** www.readwritethink.org **Reading A-Z (if applicable)** www.readinga-z.com	**Domain specific vocabulary** The terminology of a particular field of knowledge or content.

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

C. Engage in critical reading and writing of technical information.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Develop awareness of strategies that are used to monitor understanding before, during, and after reading, viewing, or listening to informational text. *(CCSS RI.PK.1)* • Listen to a wide variety of complex texts, (e.g. grade/age appropriate *science*, *technology*, *engineering*, or *mathematics* texts). *(CCSS RI.K.2;SLM K.6.A.1a)* • Recognize that thoughts and ideas can be represented in drawing and writing. *(CCSS K. W1;See MTLS K.4.B.1a)* • Generate ideas by using letter-like shapes, symbols, and letters, dictating words and phrases, and using drawings to represent ideas. *(CCSS K. W1)*	**Teacher Notes:** ○ At the beginning of the year students are drawing while teacher dictates verbal understanding. ○ By the end of the year students are writing and drawing their understanding on their own. **Suggested Activities:** During relevant STEM activities the child will draw pictures and/or write to represent knowledge. ○ After time in a center, allow students to draw about what they just did, with labels and explanations. ○ Have students practice drawing designs for inventions (e.g. new toys they may want…)	**For Planning:** **Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html (CCSS K RL, 7, 10) **ReadWriteThink** www.readwritethink.org **How Stuff Works** www.science.howstuffworks.com **UDL** – www.cast.org	**Informational text** Includes literary non-fiction, expository text, technical text, procedural text, and functional text. **Complex text** A text whose complexity is determined by quantitative, qualitative and reader task components.

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

D. Evaluate and integrate multiple sources of information (e.g.: quantitative data, video and multimedia) presented in diverse formats.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Name one or more sources of information from *science*, *technology*, *engineering*, or *mathematics*. • List different sources of information. • Match pictures to words using multiple sources of information. *(CCSS RI.K.7; MD SLM K:1 2B1.d)* • Use texts or sources to encourage students to ask and answer questions, explore global issues or solve real world problems or challenges. *(See MTLS K.4.C.1a)*	**Suggested Activities:** ○ What type of text is it? ○ Compare fiction and nonfiction text. ○ Text features vs. story elements. ○ Maps, menus, websites, non-fiction text. ○ Factual evidence to form opinion.	**For Planning:** **Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html (CCSS K RL,10)	**Global issues** Issues that impact the Earth as a whole, problems that concern a population throughout the world. A global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world. **Real world problems** Problems that actually occur in everyday life. **Challenges** A problem or concern that should be addressed. A competition.

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

E. Develop an evidence-based opinion or argument.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Participate in a discussion about learning experiences that simulates and guides thinking to express an opinion. *(CCSS W.K.1)* • After discussion, express an opinion by completing a cloze sentence orally, with a drawing, dictation or developmentally appropriate writing. *(CCSS W.K.1)* • Listen to the opinion of others. *(CCSS SL.K.1b)* • After discussion, apply the prewriting and planning stages of the writing process to an opinion. *(CCSS W.K.1)*	**Suggested Activities:** ○ Verbalize their opinion and explain their thinking (e.g. ○ Examples: ○ Class surveys – determining opinion**;** ○ Sentence starters – "I think", "I would", "I agree", "I disagree" -- questioning to help students form opinion; ○ When comparing fiction/non-fiction students can form an opinion about what they like/don't like ○ Choose a book and stop reading the book before the solution. Students form an opinion about how the book will end. Give reasons to support opinion.	**For Planning:** **Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html (CCSS K RL, 4)	**Opinion** A view or judgment formed about something.

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

F. Communicate effectively and precisely with others.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Connect personal/prior knowledge and experiences. *(CCSS SL.K.4)* • Choose appropriate visuals to match presentations. *(CCSS SL.K.5)* • Use available technology appropriately to display ideas. *(CCSS SL.K.5)* • Ability to formulate questions targeted to specific needs. *(CCSS SL. K.3)* • Speak clearly enough to be heard and understood. *(CCSS SL.K.4)* • Communicate thoughts and ideas. *(See MTLS K.4.C.1a)*	**Teacher Notes:** ○ **Classroom Environment:** The classroom environment should provide a structure for students to work as a community of learners. Students should help to establish classroom norms to support the structure. The norms should reflect: taking turns, listening to others, speaking to others, asking for help, offering help, and giving constructive feedback. **Suggested Activities:** ○ Ensure opportunities for multimedia sharing (Web 2.0 Tool (e.g. Kidspirtation, Glogster) to post online for parents or other classes to view), Cooperative groupings, ○ Utilize content word wall for discussion, content based discussions.	**For Planning:** **Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html (CCSS K RL, 4)	**Technology** Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.

STEM Standard of Practice 4: **Engage in Inquiry**

STEM proficient students will engage in inquiry to investigate global issues, challenges, and real world problems.

A. Ask questions to identify and define global issues, challenges, and real world problems.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**

Essential Skills and Knowledge
With prompting and support, students will be able to:
 	
• Ask and answer questions:
  ◦ about content specific books.
  ◦ related to global issues
  ◦ to solve real world problems or challenges. *(SLM Pk-1. 6.A.1d)*
• Pose/ask questions about the problem/situation. *(SS.K.6.C.2.b)*
• Ask and/or answer who, what, where, how, when and why questions. *(CCSS RI.K.1)*
• Make predictions based on personal interest, interests of others, or issues or problems around them.
• Ask questions to make sense of an issues or problem.
• Ask or change a question to address issues or to solve problems.
	Teacher Note:
	• Consider the appropriate lower level questions for this age:
	  ◦ what is
	  ◦ who is
	  ◦ where would you find
	  ◦ how could
	  ◦ why does
	Suggested Activities:
	Mystery Box: Use a mystery box to help students with practice of asking questions and thinking of appropriate questions to ask. Place an item in the box that the students can ask questions about to provide them clues to help find out what is in the box. The box can be sent home with students so they can choose the item for the mystery box.
	Teacher Note:
	b. Model asking questions clarifying questions. Consider using a book related to specific content to address global issues, challenges, and/or real world problems.
		For Planning:
		Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts http://mdk12.org/instruction/curriculum/reading/index.html (CCSS K RL, 1) Find more specific link to this indicator in ELA (Reading Informational Text)
		David Sobel Book for staff: *Beyond Ecophobia --* **Online article:** http
		Learning to Give Lesson examples for global issues: http://learningtogive.org/lessons/all_units.asp?grades=K-2
		For Lesson Use: Wonderopolis http://wonderopolis.org
			Global issues
			Issues that impact the Earth as a whole, problems that concern a population throughout the world. A global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world.
			Real world problems
			Problems that actually occur in everyday life.
			Challenges
			A problem or concern that should be addressed. A competition.

STEM Standard of Practice 4: **Engage in Inquiry**

STEM proficient students will engage in inquiry to investigate global issues, challenges, and real world problems.

B. Conduct research to refine questions and develop new questions.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • With modeling and support, a. listen to information related to *science*, *technology*, *engineering*, or *mathematics*. b. discuss topic related to student, school or community interests, issues, or problems. *c.* ask and answer questions to better understand the questions, problems, or issues. *(See SLM Pk-1. 6.A.1a-e)* • Explore books that have information about *science*, *technology*, *engineering*, and *mathematics*. *(SLM Pk-1. 1.B.1a)* • Learn how to change individual or group questions and create new questions.	**Suggested Activities:** ○ Select a text from the classroom library that supports STEM processes (i.e. a book about a boat, a race car, a house (The Little House would be great!)). ○ Read the book with the students and provide them with the opportunity to talk about: How do you think….? What might you use….? In regards to the engineering process. ○ Then have students use straws and play-dough or other tools to 'build' something in the classroom to solve a problem. ○ Model a question that you might ask (How can we make the slide go faster?) and then discuss what else we might want to know/what other questions might we ask.	**For Planning:** **Mathematical Practices** (see pages 6-8) http://mdk12.org/share/frameworks/CCSC_Math_grk.pdf **Engineering Design Process Model for Elementary Engineering is Elementary:** http://www.mos.org/eie/engineering_design.php **For Lesson Use:** http://www.pbs.org/teachers/stem/engineering/	**Create** To bring something into existence; to use imagination to invent things or produce works of art; to result in something or make something happen. **Information** Knowledge gained through study, communication, research, instruction, etc.; factual data. **Questions** A request for information or for a reply, which usually ends with a question mark if written or on a rising intonation if spoken.

STEM Standard of Practice 5 **Engage in Logical Reasoning**

STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

A. Engage in critical thinking.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Utilize the five senses; look, feel, taste, hear, and smell, while engaged in thinking about *science*, *technology*, *engineering*, and *mathematics* related topics. • Engage in conversation with peers and adults using appropriate vocabulary and symbols in sentences. • Verbally describe an object based on its physical characteristics. • Draw and write words or symbols to communicate his/her thoughts, ideas or knowledge. • Repeat one's own thoughts and the thoughts of others.	**Teacher Notes:** ○ Students will begin to engage in conversation with peers and adults using appropriate content vocabulary and symbols in sentences. (e.g. sum, square, circle, =, +, sweet, feel, soft) during play and instruction. ○ Students will begin to add and subtract simple one-digit number problem with the sum/difference of ten and less. (e.g. 3 + 2 = 5; 5 – 3 = 2) and orally state the problem. ○ Students should be able to verbally describe an object based on its physical characteristics (e.g. size, shape, color, texture, and scent and taste when appropriate and safe). ○ Students will begin to identify and describe what simple man-made appliances/tools look like and what they are used for. (e.g. Garden tools and table utensils: What can we use to cut a paper? What can we use to write/draw?) ○ Student will begin to draw, illustrate or write appropriate symbols to communicate his/her knowledge.	**For Planning and For Lesson Use:** **Exploratorium – Science Videos** www.exploratorium.edu **Try Science - experiments** www.tryscience.org	**Utilize** To put to use, especially to find a profitable or practical use for

STEM Standard of Practice 5: **Engage in Logical Reasoning**

STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

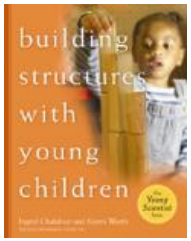
B. Evaluate, select, and apply appropriate systematic approaches (scientific investigations, engineering design processes, and/or mathematical practices).

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Begin to apply step by step strategies for practicing what is learned in *science*, *technology*, *engineering*, and *mathematics*. • Begin asking questions, exploring global issues or solving real world problems. • Find information to answer questions or solve real world problems. • Refine steps to see a different answer or solution. • Draw or write a picture of one's mental image of the steps when investigating global issues or solving real world problems or challenges. • Recall previous steps. • Recognize ideas can be repeated. • Begin to use *science practices* and *Standards for Mathematical Practices* to solve real world problems or challenges.	**Teacher Notes:** ○ Students should have opportunities to apply practices within content instead of in isolation. When problem solving, the teacher should help students recognize the step in the process they are using. Remind students that they are working as mathematicians, scientist, engineers, etc. ○ Step by step organizers should be simplified for primary students. Use visual cues such as graphics/props or kinesthetic movements to help students create a mental image of the steps. ○ Capture moments when students are not going step by step. Help all students understand based on their experiences that the steps do not always go in order and steps can be revisited (e.g. cyclical, not linear). **Suggested Activities:** ○ Use catchy tunes and use the steps of processes to change the lyrics. ○ To the tune of *If You're Happy and You Know It*: ○ If you're working like an engineer, you're solving a problem ○ If you working like an engineer, you're imagining your creation. ○ If you plan, create, and revise ~ to make your dream come alive. ○ If you're working like an engineer, you're solving a problem.	**For Planning: Mathematical Practices (see pages 6-8)** http://mdk12.org/share/frameworks/CCSC_Math_grk.pdf **Engineering Design Process Model for Elementary** Engineering is Elementary: http://www.mos.org/eie/engineering_design.php **Maryland Technology Literacy Standards for Students K-8 (see pages 23-25)** http://marylandpublicschools.org/NR/rdonlyres/CFAE6DE8-94E4-4D72-A1DE-50061B2B2A05/13089/MTLSSComplete1.pdf **A Framework for K-12 Science Education (See pages 3.28-3.32)** http://www.nap.edu/catalog.php?record_id=13165	**Global issues** Issues that impact the Earth as a whole, problems that concern a population throughout the world. A global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world. **Real world problems** Problems that actually occur in everyday life. **Challenges** A problem or concern that should be addressed. A competition.

STEM Standard of Practice 5: **Engage in Logical Reasoning**

STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

C. Apply science, technology, engineering, and mathematics contents to construct creative and innovative ideas.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Explore products/models that use *science*, *technology*, *engineering*, and *mathematics*. • Identify products/models. • Manipulate materials to create new ideas. • Build simple model. • Use a mixture of tools to solve real world problems and meet challenges. • Explain their model to others.	**Suggested Activities:** ○ Given a scenario, or after reading a story, give children an opportunity to build and/or design a scene. They should build structures and be able to explain their thinking. ○ Teacher may allow the use of materials such as clay and tongue depressors, marble run set, KEVA building planks, Legos, blocks, etc. ○ When students are finished building, have them take digital pictures of their designs/creations. ○ These could be used in a variety of ways: in a portfolio to show development and growth over time, to create a book in iPhoto using their own words to describe what they did and how they came to develop the idea, or could be used as inspiration by being hung around the classroom beside a picture of the student "architect" who built it. ○ Allow opportunities for students to orally present their ideas and explanations to others.	**For Planning:** Building Structures with Young Children  **For Lesson Use:** Marble Run –Mindware Activity Set KEVA Plank - Building set (http://www.kevaplanks.com	**Innovative** An improvement of existing technological product, system, or method of doing something. **Real world problems** Problems that actually occur in everyday life. **Challenges** A problem or concern that should be addressed. A competition.

STEM Standard of Practice 5: **Engage in Logical Reasoning**

STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

D. Analyze the impact of global issues and problems at the local, national, and international levels.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Identify home, school neighborhood and community through pictures and words. • Identify and describe how a globe and maps can be used to help people locate places. *(SS.K.3.A.1)* • Brainstorm real world problems that occur in the home, school, neighborhood or community. • Understand the past and present when exploring global issues or real world problems. • Discuss historical or current issues and topics using *science*, *technology*, *engineering*, and *mathematics* content that are relevant to student's or other's home, school, neighborhood, or community.	**Teacher Notes:** ○ Students will begin to independently ask and answer questions related to their home, school, neighborhood and community. **Suggested Activities:** ○ Students brainstorm and make a list of wants and needs within the home, school, neighborhood, or community. ○ Students discuss and make a list of problems within the home, school, neighborhood, or community (friendship, pollution, safety) ○ Discuss how students could help in their home, school, neighborhood, or community with the problems they identified. ○ Students look at pictures of schools, communities and various media forms (T.V., cell phone, video games) from the past and present. They should recognize that they are different and give an example of how they have changed. Discuss what problems these have solved over time. ○ Students can identify roles in the community, school and home by completing a picture sort (fireman, doctor, housekeeper, and teacher)**.**	**For Planning and For Lesson Use:** www.scholastic.com social studies, community, neighborhood http://www.thinkport.org/default.tp **search 'community'**	**Global issues** Issues that impact the Earth as a whole, problems that concern a population throughout the world. A global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world. **Real world problems** Problems that actually occur in everyday life.

STEM Standard of Practice 6: **Collaborate as a STEM team**

STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

A. Identify, analyze, and perform a science, technology, engineering, and mathematics specific subject matter experts (SME) role.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Identify a scientist, technologist, technician, engineer, and mathematician. • Recognize workers as human resources. *(SS. K.4.A.2.a)* • Explore different STEM specific subject matter experts' roles. • Ask questions to learn what a scientist, technologist, technician, engineer, and mathematician does. • Role play what a scientist, technologist, technician, engineer, and mathematician do in the work place. • Work cooperatively with others when asking and answering questions, investigating global issues, or solving real world problems, or challenges.	**Teacher Notes:** The teacher should provide a structure for students to practice roles for working cooperatively in centers and/or completing tasks. Students should be given opportunities to understand how to work in roles specific to these centers and/or tasks. **Suggested Activities:** ○ Students use tools such as magnifier class, pipette, ruler, microscope, in the correct and appropriate manner. ○ Students understand that scientist explore the area around them to find out information. For example, students go on a nature walk to discover leaves. They can sort the leaves by different attributes. They can make graphs based upon the type of leaves they found. They can describe similarities and differences between the leaves. Students can work cooperatively to create leave collages. ○ Students understand that engineers construct (or make) buildings and structures. After reading a story about the gingerbread man, students work in a group to brainstorm, design, and build a trap to	**For Planning:** **Examples of cooperative learning role cards that could be revised for primary students:** http://www.readwritethink.org/files/resources/lesson_images/lesson277/cooperative.pdf http://www.readwritethink.org/files/resources/lesson_images/lesson95/coop_rules.pdf http://www.asdk12.org/MiddleLink/Inter/mosaic/Coop_Placards.pdf **Gingerbread Trap Activity** http://www.eschoolnews.com/2010/04/02/integrating-stem-in-the-elementary-years-your-lesson-plans-may-already-hold-the-	**Roles** The actions and activities assigned to or required or expected of a person or group; "the function of a teacher"; "the government must do its part"; "play its role." ***pipette*** medicine dropper

	catch the gingerbread man. • Students understand that scientists, technician, engineers, and mathematicians gather and organize information. Students complete simple data sheets with questions about physical characteristics of an object. For example: The apple is _____ (red or purple). The apple tastes _____ (sweet or sour). My pencil is _____ (long or short)	answer/	

STEM Standard of Practice 6: **Collaborate as a STEM team**

STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

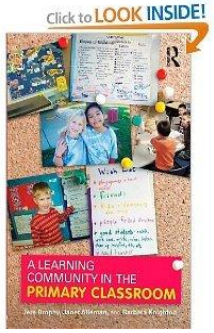
B. Share ideas and work effectively with a STEM focused multidisciplinary team to achieve a common goal.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Identify the importance of rules. *(SS.K.1.A.1)* • Understand the rules and expectations of working in a group or team. • Share ideas and work with others in a timely manner to complete a common task or goal. • Identify a STEM role, such as time keeper. • Perform a STEM role.	**Suggested Activities:** ○ **Role Play Ideas:** Role cards are provided for students to know the expectations of them to function as a group. ○ They can be general such as time keeper, materials, etc. Student will rely on the time keeper to meet this indicator. ○ The teacher will need to provide support such as setting the time so the time keeper can watch for the time remaining. ○ The teacher could provide a "2 minute warning" to give the students a notice that their time is going to run out very soon.	**For Planning:** **Examples of cooperative learning role cards that could be revised for primary students**: http://www.readwritethink.org/files/resources/lesson_images/lesson277/cooperative.pdf http://www.readwritethink.org/files/resources/lesson_images/lesson95/coop_rules.pdf http://www.asdk12.org/MiddleLink/Inter/mosaic/Coop_Placards.pdf	**Role** The actions and activities assigned to or required or expected of a person or group; "the function of a teacher"; "the government must do its part"; "play its role."

STEM Standard of Practice 6: **Collaborate as a STEM team**

STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

C. Listen and be receptive to ideas of others.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Listen and respond appropriately to ideas of others and use other's ideas as appropriate when completing a team task. • Listen to questions and ideas of others in a team. • Respond to others ideas and questions. • Take turns when others are speaking. • Share ideas with others. • Respect the ideas of others. • Identify, discuss, and demonstrate appropriate social skills, such as listening to the speaker, taking turns, settling and taking turns that help people live, work and play together at home and in school. *(SS.K.2.C.1.a)*	**Teacher Notes:** ○ **Classroom Environment:** The classroom environment should provide a structure for students to work as a community of learners. Students should help to establish classroom norms to support the structure. The norms should reflect: taking turns, listening to others, speaking to others, asking for help, offering help, and giving constructive feedback. ○ **Role Play:** Provide opportunities for students to role play/practice such behavior established through the classroom norms. Students can be provided these opportunities through games and centers.	**For Planning:** **A Learning Community in the Primary Classroom, Brophy** 	

STEM Standard of Practice 6: **Collaborate as a STEM team**

STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

D. Analyze career opportunities that exist in a variety of STEM fields relevant to the STEM focused multidisciplinary team's goal.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Name a STEM professional. • Identify in picture and word a STEM professional. • Listen to stories or media on STEM professionals. • Make connections to similarities and differences among STEM professionals. • Identify and role play different STEM career professions. • Role play community STEM professionals.	**Suggested Activities:** ○ **Centers/Role Play:** The students should have opportunity to interact in a situational center to act out the career through role playing. They would have the opportunity to explore with materials and tools (including technology). They should have the opportunity to record/respond about the materials, tools, and experience in the center. ○ **Center examples**: Architect Studio, Paleontologist Site, Archeologist Site, Chemist Lab, Environmental Center, Zoologist Clinic ○ Students can bring appropriate items from home to add to the centers to show their connections/applications to the career. **Teacher Notes:** ○ Student can work into working with roles/jobs in the center. Roles/jobs would be specified according to the type of center and would still address STEM. ○ Consider the roles in STEM careers that exist in their community or their experience as a Kindergartener. A person in that particular career could "unveil" the center to the class. The students can ask "expert" questions before they role play.	**For Planning:** Thinkport: www.thinkport.org **Career Websites:** http://www.sciencebuddies.org/science-fair-projects/science_careers.shtml http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Women_at_NASA.html **For Lesson Use:** **Wonderopolis:** http://wonderopolis.org/wonder/what-do-you-want-to-be-when-you-grow-up/	

STEM Standard of Practice 7: **Apply Technology Strategically**

STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

A. Identify and understand technologies needed to develop solutions to problems or construct answers to complex questions.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Explain what technology is. • Begin to be aware of technology and how it affects life. *(SS.K.4.A.3.a)* • Identify different types of technology people use every day. • Sort pictures or objects that represent different types of technology.	**Suggested Activities:** ○ **What Is Technology?** The students should explain what is or is not technology. ○ The students should understand that technology is beyond electronics. ○ Students can sort pictures or look at technology in their classroom, school, and home. ○ Anything man made can be considered technology: chair, table, telephone and/or cell phone, computer, camera, pencil, smart board, etc. These are examples that make life better for humans, animals, etc.	**For Planning:** **Standards for Technological Literacy:** http://www.iteea.org/TAA/PDFs/xstnd.pdf www.mdk12.org/instruction/mmsrexemplars (Technology is referenced under Standard) 4.0 **For Lesson Use: Engineering is Elementary®** (a resource that may be used by your system)	**Technology** Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.

STEM Standard of Practice 7: **Apply Technology Strategically**

STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

B. Analyze the limits, risks, and impacts of technology.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Define the meaning of the words limits and risks. • Identify there are limits using technology. • Identify when risks happen when using technology. • Recognize when technology doesn't work.	**Teacher Notes:** ○ The students should be able to recognize that there are limitations with technology and identify the reasons of these limitations. ○ Limitations may include limited access-not enough or the same technology for everyone. ○ Risk of improper usage – may break. ○ Teacher models that risk can have a positive impact or have a negative impact. Build a tower using blocks. Adding blocks to the top of the tower will be positive in that the building will be taller. It can also be a risk because the taller the building the greater the chance the tower will fall over. ○ From the activity above students can generate answers to: How could a computer help you? How can a computer be bad for you?		**Technology** Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities. **Limit** A boundary. **Risks** A factor, thing, element, or course involving uncertain danger; a hazard.

STEM Standard of Practice 7: **Apply Technology Strategically**

STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

C. Engage in responsible/ethical use of technology.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Learn and apply the rules of using technology and sharing technology with others *(See MTLS K.2.B.1).* • Use gentle and positive behaviors when using technology. • Take turns when using technology. • Apply the appropriate use ~ state and district policy *(See MTLS K. 2.B.1a)*.	Maryland Technology Literacy Standard for Students #2: Digital Citizenship **Teacher Notes:** ○ The students should be exposed to the appropriate vocabulary associate with technology to aid with proper use (mouse, keyboard, monitor, power switch, etc.). ○ The teacher should establish manageable guidelines and rules for using and sharing technology. ○ By establishing rules for proper usage the students should understand the importance of proper handling and usage of the equipment. ○ The teacher will need to model what the proper usage of technology.	**For Planning:** ***Refer to you district policies for digital citizenship.** **Technology Literacy Standards:** www.montgomeryschoolsmd.org/departments/techlit **Technology in Early Childhood Programs from NAEYC:** http://www.naeyc.org/positionstatements/technology **For Lesson Use:** www.cyberwatchcenter.org www.Netsmartzkids.org	**Technology** Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.

STEM Standard of Practice 7: **Apply Technology Strategically**

STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.

D. Improve or create new technologies that extend human capacity.

Grades: Kindergarten	**Instructional Notes and Examples**	**Resources**	**Glossary**
Essential Skills and Knowledge With prompting and support, students will be able to: • Distinguish among past, present, and future times. (SS.K.5.A.1) • Understand that technology changes over time. • Identify past and present technology through pictures. *(MTLS K.4.B.1a)* • Identify time or date using technology. • Understand how timelines show a progression over time. • Draw and write new ideas to better technology. • Draw or build safe simple model using technology or technological tools. • Explain how technology affects the way people live, work, and play. ((*MTLS K.2.A.1b;* SS.4.K.3) • Begin to be aware of technology and how it affects life. ((*MTLS K.2.A.1c* ;SS.4.K.3a)	**Suggested Activities:** ○ **Technology Change:** Provide students with examples/items that have changed over time such as phone, book bags or lunch boxes, hand held games, TV, record player to iPod, books, etc. ○ Create a timeline to display examples of how technology has changed. Use pictures to display on the timeline. The students can use the pictures to help them to describe. ○ Have the students select an example of technology to change. For example, what do you think the next television will look like? Have the students use drawings to share their ideas of their design	**For Planning:** **Photographs and descriptions of items in the National American History Museum:** http://www.americanhistory.si.edu/collections/index.cfm http://historyexplorer.americanhistory.si.edu/search/?query=&search_origin=artifacts&resource=1%253b&era=158%253b&session=5dcf44cf73334d369f5475b731e8ca56	**Technology** Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.

Appendix A

Abbreviations

Grades K - 5

CCSS W.K:5: Common Core State Standards Writing Grades K-5
CCSS RI.K.5: Common Core State Standards Reading Informational Text Grades K5
CCSS SL.K.5: Common Core State Standards Speaking and Listening Grades K-5
CCSS L.K.5: Common Core State Standards Language Grades K-5
CCSS RL.K:5: Common Core Reading Literature Grades K-5
SS K: 5: Maryland State Curriculum-Social Studies K-5
MS SLM K-5: School Library Media State Curriculum K-5
MTLSSS – Maryland Technology Literacy Standards for Students Grades K-5

Online Maryland State Curriculum-Content Standards

Content	Standards Online Websites
Science and Engineering	**A Framework for K:12 Science Education** http://www.nap.edu/catalog.php?record_id=13165
Technology	**Maryland Technology Literacy Standards for Students K:8** http://marylandpublicschools.org/NR/rdonlyres/CFAE6DE8:94E4:4D72:A1DE:50061B2B2A05/13089/MTLSSSComplete1.pdf
International Technology and Engineering Educator's Association (ITEEA)	**ITEEA** http://www.iteaconnect.org/TAA/PDFs/ListingofSTLContentStandards.pdf **Standards for Technology Literacy: Content for the Study of Technology** http://www.iteaconnect.org/TAA/PDFs/xstnd.pdf
Mathematics	Maryland Common Core State Curriculum Frameworks – Mathematics http://mdk12.org/instruction/curriculum/mathematics/index.html
Reading / English Language Arts	**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html
School Library Media State Curriculum	**School Library Media State Curriculum** http://www.marylandpublicschools.org/NR/rdonlyres/EC67FB12-FE6B-464A-A2AD-D0C6307773E3/26323/MS_SLM_SC_Accepted_GRpk8.pdf
Social Studies	**Social Studies** http://mdk12.org/instruction/curriculum/social studies/index.html
Fine Arts	**Fine Arts** http://www.mfaa.msde.state.md.us/source/MDFA_index.asp

Appendix B

Elementary School STEM Standards of Practice Framework and Instructional Guide Glossary

Academic Vocabulary: Terms necessary for understanding ideas across curricular areas.

Access: A way or means of approach.

Accuracy: Degree of conformity of a measure to a standard value.

Action plan: A series of steps and/or activities that must be successfully completed to achieve a goal.

Active listening: Listening that focuses entirely on what the other person is saying and confirms understanding of both the content of the message and the emotions and feelings underlying the message to ensure that understanding is accurate.

Analogy: A comparison between two things for a purpose of explanation or clarification; see simile, metaphor.

Analysis: Identification and evaluation of data, material, and sources for quality of content, validity, credibility and relevance; student compares and contrasts sources and findings and generates summaries and explanations of source materials.

Analyze: To examine something in great detail in order to understand it better or discover more about it.

Anecdotal record: Significant incidents or specific, observable behaviors can be recorded by teachers in anecdotal records. These records provide cumulative information about students' development in the learning objectives of the language arts as well as their physical and social growth and development. By systematically collecting and analyzing anecdotal comments, teachers can evaluate students' progress and abilities to use language and then plan appropriate instruction.

Anecdotes: Brief interesting or amusing life stories used to make a point.

Applies technology to task: Understands the overall intent and the proper procedures for setting up and operating machines, including computers and their programming systems.

Apply: To bring into action; use; employ.

Argument: A purpose for writing using reasons or evidence to support a claim or opinion.

Brainstorming: A method of shared problem solving in which all members of a group spontaneously and in an unrestrained discussion generate ideas.

Challenges: A problem or concern that should be addressed. A competition.

Close read: Observing facts and details about a text and interpreting those details.

Collaboration: The ability to work effectively with diverse teams; be helpful and make necessary compromises to accomplish a common goal.

Communication: The successful transmission of information through a common system of symbols, signs, behavior, speech, writing, or signals.

Compare and contrast: Organizational structure in which the difference and similarities across or within two texts are highlighted or could demonstrate a preference for one thing over another.

Complex question: An open ended question that promotes higher order thinking skills and requires students to synthesize information from multiple sources to develop answers.

Complex text: A text whose complexity is determined by quantitative, qualitative, and reader task components.

Computer literacy: The terminology and range of skills required to successfully use computers and other devices associated with computers.

Connection: The relationship of something with its context.

Constraint: A limit to the design process. Constraints may be such things as appearance, funding, space, materials, and human capabilities.

Content: The subjects or topics covered in a book or document.

Copyright: The exclusive legal right to reproduce, publish, sell, or distribute the matter and form of something.

Create: To bring something into existence; to use imagination to invent things or produce works of art; to result in something or make something happen.

Creative problem solving: Process to identify problems, generate ideas, and create an action plan to solve the problem.

Creative thinking or ideas: The ability or power used to produce original thoughts and ideas based upon reasoning and judgment.

Critical reading: Means reading with the goal of finding deep understanding of a material, whether it is fiction or nonfiction. It is the act of analyzing and evaluating what you are reading as you progress, or as you reflect back.

Critical thinking: The ability to acquire information, analyze, and evaluate it, and reach a conclusion or answer by using logic and reasoning skills.

Cyber bullying: Harassing or being mean to someone in an online environment.

Cyberethics: Ethics related to computer usage.

Data: Collected information which can be quantitative (numerical) or qualitative (descriptive). Factual information used as a basis for reasoning, discussion, or calculation.

Decision-making: The act of examining several possible behaviors and selecting from**.**

Demonstrate: Explain or describe how something works or how to do something; show or prove something clearly and convincingly.

Design process: A systematic problem-solving strategy, with criteria and constraints, used to develop many possible solutions to solve a problem or satisfy human needs and wants and to winnow (narrow) down the possible solutions to one final choice.

Design: An iterative decision making process that produces plans by which resources are converted to products or systems that meet human wants or needs or to solve problems. To create or construct according to a plan.

Develop: To elaborate or expand in detail.

Digital etiquette: The conventional rules or personal behavior pertaining to courteous online practices. For example, considering sensitivities, multiculturalism, diversity, conventions, and tone.

Discipline: A formal branch of knowledge or teaching (e.g., biology, geography, and engineering) that is systematically investigated, documented, and taught.

Divergent questions: Open ended questions that have more than one correct answer, or more than one correct way to solve them.

Domain specific vocabulary: The terminology of a particular field of knowledge or content.

Educational technology: Using multimedia technologies or audiovisual aids as a tool to enhance the teaching and learning process.

Effectively: In an effective manner; "these are real problems that can be dealt with most effectively by rational discussion.

Engineer: A person who is trained in and uses technological and scientific knowledge to solve practical problems.

Engineering design process: The process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic science and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective.

Engineering design: The systematic and creative application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.

Engineering: The profession of or work performed by an engineer. Engineering involves the knowledge of the mathematical and natural sciences gained by study, experience, and practices that are applied with judgment and creativity to develop ways to utilize materials and forces of nature for the benefit of mankind.

Environmental print: The identification or recognition of print or non-print in familiar settings.

Essential skills: What students need in order to master a specific STEM Standards of Practice Student proficiency.

Ethics: Moral principles that govern an individual or groups behavior.

Ethics: A set of moral principals or values; A theory or system of moral values (the present-day materialistic ethic); Plural but singular in construction; The principal of conduct governing a individual or group.

Etiquette: The conduct or procedure required by good breeding or prescribed by authority to be observed in social or official life.

Evaluate: To consider or examine something in order to judge its value, quality, importance, extent, or condition.

Evaluation: Judge the product (effectiveness); judge the process (efficiency).

Evidence: Facts, figures, details, quotations, or other sources of data and information that provide support for claims or an analysis that can be evaluated by others; should appear in a form and be derived from a source widely accepted as appropriate to a particular disciplines, as in details or quotations from a text in the study of literature and experimental results in the study of science.

Expository text: The nature of exposition; serving to expound, set forth, or explain.

Facilitate: To help bring about learning or make learning easier.

Figurative language/meaning: A type of language that does not mean explicitly what it says; contains words and phrases that require a reader to make inferences and use his/her imagination in order to create a more vivid image or real experience.

Figures of speech: a non-literal expression in which the meaning is ironic, metaphorical, or rhetorical.

Foundation questions: Questions that are derived from overarching questions. These are the “What is…” questions. Their answers are absolute and are usually singular (only one right answer).

Gather: To learn from information given; conclude or assume.

Global issues: Issues that impact the Earth as a whole, problems that concern a population throughout the world. An global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world.

Graphic organizer: Different ways to visually organize information.

Hypothesis: A tentative answer to a question, from which testable prediction can be generated.

I Do, We Do, You Do: An instructional strategy where practice is scaffolded to support the learners needs. The teacher models for students, students work in groups for guided practice and then finally students work.

Identify: To recognize somebody or something and to be able to say who or what he, she, or it is.

Implication: Something suggested as naturally to be inferred or understood.

Independent(ly): A student performance done without scaffolding from a teacher, other adult, or peer.

Inference: A logical guess based on text evidence and the reader's prior knowledge.

Information: Knowledge gained through study, communication, research, instruction, etc.; factual data.

Informational text: Includes literary non-fiction, expository text, technical text, procedural text, and functional text.

Innovation: An improvement of existing technological product, system, or method of doing something.

Innovative: Demonstrating originality and inventiveness in work; developing, implementing and communicating new ideas to others; being open and responsive to new and diverse perspectives.

Inquiry based learning: Learning that can be applied to all disciplines. Individuals need many perspectives for viewing the world. Such views could include artistic, scientific, historic, economic, and other perspectives. While disciplines should interrelate, inquiry learning includes the application of certain specific "ground rules" that insure the integrity of the various disciplines and their world views.

Inquiry: A seeking or request for truth, information, or knowledge – an investigation.

Integrate: Combine knowledge from multiple disciplines.

Interdisciplinary: Across content or discipline areas.

Investigation: An examination or inquiry into something, especially a detailed one that is undertaken officially, or the act of undertaking an examination.

Issue: Point of matter or dispute which is special to public importance.

Language of the discipline: The language professionals in a given field use to communicate with their peers.

Lesson module: A unit of education or instruction with a relatively low student-to-teacher ratio, in which a single topic or a small section of a broad topic is studied for a given period of time.

Lesson: A period of instruction; a class. An assignment or exercise in which something is to be learned. An act or instance of instructing/teaching.

Limit: A boundary.

Listening: To hear something with thoughtful attention, to give consideration.

Local: In close proximity to a given location, community.

Logic: The ability to use reasoning to determine relationships among propositions in terms of implication, contradiction, contrariety, and conversion.

Logical reasoning: How things fit together.

Mathematical practices: Processes and proficiencies as described in a variety of mathematical expertise.

Mathematics: The science of numbers and their operations, interrelations, combinations, generalizations, and abstractions and of space configurations and their structure, measurement, transformations, and generalizations.

Metacognition: Is defined as "cognition about cognition", or "knowing about knowing." It can take many forms; it includes knowledge about when and how to use particular strategies for learning or for problem solving.

Model : A replica of a larger object or product.

Module: A self-constrained unit.

Netiquette: Etiquette governing communication on the Internet.

New: Unfamiliar or novel to the student.

Nonfiction/informational text: The branch of literature comprising works of narrative prose dealing with or offering opinions or conjectures upon facts and reality, including biography, history, and the essay.

Opinion: A view or judgment formed about something.

Overarching Questions: Questions that are not answerable with finality in a brief sentence. Typically, further research is required to answer overarching questions. Their aim is to stimulate thought, to provoke inquiry, and to spark more questions.

Piracy: Stealing computer software.

Plan: A scheme or method of acting, doing, proceeding, making, etc., developed in advance.

Precisely: Used to indicate that something is stated exactly; with absolute accuracy.

Primary source: A first-hand account of an event.

Prior knowledge: Information that a student knows before a lesson/instruction/research/exploration.

Problem solving: The process of understanding a problem, devising a plan, carrying out the plan, and evaluating the plan in order to solve a problem or meet a need or want.

Problem-base learning: (PBL) is a student-centered pedagogy in which students learn about a subject in the context of complex, multifaceted, and realistic problems (not to be confused with project-based learning).

Problems: An issue concerning one or more people.

Proficient: Performance that meets the criterion established in the Standards as measured by a teacher or assessment.

Proficiently: A student performance that meets the criterion established in the Standards as measured by teacher or assessment.

Project based learning: Is a systematic teaching method that engages students in learning important knowledge and 21st century skills through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and learning tasks.

Prototype: A full-scale working model used to test a design concept by making actual observations and necessary adjustments.

Question: A request for information or for a reply, which usually ends with a question mark if written or on a rising intonation if spoken.

Real world problems: Problems that actually occur in everyday life.

Real world: The realm of practical or actual experience, as opposed to the abstract, theoretical, or idealized sphere of the classroom, laboratory, etc.

References: A spoken or written comment that either specifically mentions or calls attention to somebody or something or is intended to bring somebody or something to mind.

Refine: To clarify, improve, and polish a research question or information need throughout the inquiry process.

Relevant ideas: Any thoughts, conceptions, or notions pertinent to a learning activity.

Relevant information: Knowledge gained through study, communication, research, instruction etc. pertinent to a learning activity.

Research: Identification and utilization of appropriate strategies to explore and answer problems and to conduct research on a range of questions.

Researchable question: A clear and concise question that has a means of which to be answered through investigation.

Risk: A factor, thing, element, or course involving uncertain danger; a hazard.

Role: The actions and activities assigned to or required or expected of a person or group; "the function of a teacher"; "the government must do its part"; "play its role."

Runoff: The portion of precipitation on land that ultimately reaches streams often with dissolved or suspended material.

Science: Knowledge about or study of the natural world based on facts learned through experiments and observations.

Scientific method: A method of research in which a problem is identified, relevant data are gathered, a hypothesis is formulated from these data, and the hypothesis is empirically tested.

Self-directed: Monitoring one's own understanding and learning needs; demonstrating initiative to advance professional skill levels; **defining, prioritizing and completing tasks without direct oversight;** demonstrating commitment to lifelong learning.

Skill: An ability that has been acquired by training or experience.

Solution: The successful action of solving a problem, the answer that fixes the problem.

Source: A work, etc. supplying information or evidence (esp. of an original primary character) as to some fact, event, or series of these. Could also be a person supplying information, an informant, a spokesman.

Strategic reader: A student who naturally internalizes the reading process – before, during and after reading strategies.

Strategies: A plan, method, or series of maneuvers or stratagems for obtaining a specific goal or result.

Subject matter expert: A person who as comprehensive and/or authoritative knowledge or skill in a particular area or topic.

Synthesis: Organize from multiple sources; present the information.

Synthesize: To merge new information with prior knowledge, to form a new idea, perspective, or opinion: to generate insight.

Systematic approach: Repeatable and learnable through a step by step procedure.

Team: Cooperative learning strategies.

Technical audiences: Audience consisting of practitioners in the field of engineering, technology, design, business, and other workforce-related disciplines.

Technical information: Belonging to or involving a specialized subject, field, or profession.

Technical texts: Formula reading relating to or characteristic of a particular field.

Technical writing: Treating a document with the goal of providing clear and concise information, rather than entertainment or story telling; a technical document/report incorporates diagrams and multi-media information to provide technical information.

Technological tool: A device used by humans to complete a task. These tools may include rulers, protractors, computer softwares, CAD programs, etc.

Technology literacy: The ability to use, manage, understand and assess technology.

Technology: Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.

Test: A method for collecting data; a procedure for critical evaluation.

Tool: Device for precise measurement and/or construction.

Topic: Subject of conversation or discussion.

Transdisciplinary: In the transdisciplinary approach to integration, teachers organize curriculum around student questions and concerns. Students develop life skills as they apply interdisciplinary and disciplinary skills in a real-life context. Two routes lead to transdisciplinary integration: project-based learning and negotiating the curriculum. (Drake & Burns, 2005)

Units: Are a series of lessons that address the same resource or theme.

Utilize: To put to use, especially to find a profitable or practical use for

Weigh: Assess the importance of (a contribution) in making a decision.

Appendix C

References

"**School Improvement in Maryland"—Glossary***

English Language Arts http://www.mdk12.org/instruction/curriculum/reading/glossary.shtml

School Library Media http://mdk12.org/instruction/curriculum/library_media/index.html

Social Studies http://mdk12.org/assessments/vsc/social_studies/bygrade/glossary.shtml

Technology Education http://mdk12.org/instruction/curriculum/technology_education/index.html

21st Century Skills http://www.p21.org/

Online References

- Active Listening - Adapted from http://wik.ed.uiuc.edu/index.php/Active_listening
- Copyright - Adapted from http://www.copyrightkids.org/
- Creative Problem Solving Process - http://www.creativeeducationfoundation.org/our-process/what-is-cps
- Critical thinking - Adapted from http://dictionary.reference.com/browse/critical+thinking
- Cyberethics - Adapted from https://docs.google.com/viewer?a=v&q=cache:Ks6kijGdLylJ:iris.nyit.edu/~mtehrani/Week2_assignment1_MTehrani.pdf+&hl=en&gl=us&pid=bl&srcid=ADGEESiedhumnaTwb2KEVqbjj95ITRopzPbbN9pBTYmr7xX10KJxKeV3_xjSSYaB_iNG8vGW1vmVL1bXpxQwTTnQTsnxjSHtMOqeFugWYwMos0vRmT3MzYNJcV9kbpsUJ80plLrFiCQL&sig=AHIEtbTBP_vhfRFUNC0QY4fltkm3epyCEw&pli=1
- Cybyer Bullying - Adapted from http://www.stopcyberbullying.org/
- "Dictionary.com" http://dictionary.reference.com/
- Divergent questions - Adapted from http://www4.uwsp.edu/education/lwilson/learning/quest2.htm
- Engineering Design Process - Adapted from http://www.me.unlv.edu/Undergraduate/coursenotes/meg497/ABETdefinition.htm
- Etiquette - Adapted from http://www.merriam-webster.com/dictionary/etiquette
- Global Issues -Adapted from http://dictionary.reference.com/browse/issue?s=t
- Hacking - Adapted from http://www.techterms.com/definition/hacker
- Implication - Adapted from http://dictionary.reference.com/browse/implication
- Issue - Adapted from http://dictionary.reference.com/browse/issue?s=t
- Jigsaw/expert group - definition adapted from: A cooperative learning structure where group members become experts in a given topic and teach the other members of the group. http://www.jigsaw.org (please add this link to our resource column) Engineering Design Cycle - (Change to Engineering Design Process and delete Engineering Design Cycle from the Glossary) Design -

http://www.merriam-webster.com/ Create - http://www.merriam-webster.com/ Adapts - http://www.merriam-webster.com/ Model - http://www.merriam-webster.com/ Tool - http://www.merriam-webster.com/ Innovation - adapted from Dictionary.com Cooperative learning strategies - (needs definition) Collaboration - http://www.merriam-webster.com/ Team - http://www.merriam-webster.com/ SME - Subject Matter Expert - MSDE Plan - http://www.merriam-webster.com/ SME - Subject Matter Expert - MSDE Listening - http://www.merriam-webster.com/dictionary/listen

- Netiquette - Adapted from http://www.bpl.org/kids/netiquette.htm
- Piracy - Adapted from http://www.techterms.com/definition/piracy
- Project-based learning - Adapted from http://pbl-online.org/About/whatisPBL.htm
- Science -Adapted from http://dictionary.reference.com/browse/science
- Scientific method - Adapted from http://www.me.unlv.edu/Undergraduate/coursenotes/meg497/ABETdefinition.htm
- Solution -Adapted from http://dictionary.reference.com/browse/solution?s=t